NORTH DAKOTA

Forest Pest Conditions

and

Survey Report

1989

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FOREST PEST CONDITIONS AND SURVEY REPORT

by

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INTRODUCTION

From early May until October of 1988 and 1989, statewide surveys for insect and disease pests of native and planted trees and shrubs were conducted in North Dakota.

With the aid of USDA-Forest Service funding, over 250 locations were inspected and more than 250 landowners were contacted in each of the two years. Technical assistance was also provided on pest identification, evaluation, and control. This report summarizes forest insect and disease conditions for North Dakota in 1988 and 1989.

SURVEY METHODS

Pest survey methods included examination of representative samples from all the major types of forest resources found in the state. Field investigations were conducted in native forests, shelterbelts, park and recreation areas, urban forests, and other forested areas. The incidence of forest pests was recorded for each location. Special emphasis was placed on those pests recognized by resource professionals as having the greatest potential for causing significant damage to tree and shrub resources.

Particular attention was given to the incidence and impact of ash bark beetles, because of recent damage reports received from resource managers. Drought conditions across the state, no doubt, made the trees more vulnerable to attack by bark beetles and other insects that would normally be considered secondary.

Technical assistance including identification, evaluation, and control recommendations, was provided to private landowners and resource managers when requested. Training on forest pest management was also given to North Dakota Forest Service employees. In addition, 169 people were given training in 1989 and 134 attended training sessions in 1988. Survey information was presented to several groups representing individuals and agencies involved in resource management.

RESULTS

In each of the two field seasons, forest insect and disease conditions were evaluated in more than 250 locations across the state. More than 500 people, many seeking aid in pest identification and evaluation, were contacted in the two years. Considerable time was spent visiting groups with special interests in forest pest problems. Included were visitations to city foresters, park supervisors, nurserymen, researchers, SCS district conservationists, plant material specialists, North Dakota Game and Fish Department personnel, and North Dakota Forest Service district foresters.

In addition to the public contacts made through this survey, North Dakota Forest Service personnel responded to 265 requests for forest pest management assistance in 1988 and 284 in 1989. Requests came primarily from community officials, homeowners, and private woodland owners. The majority of these requests required on-site evaluation of forest pest conditions and, in some cases, making control recommendations.

SPECIFIC PESTS

The following pages describe the specific forest pests most commonly encountered in 1988 and 1990. Tables I and II contain more extensive lists rating each by present and potential importance.

BORERS AND BARK BEETLES

Ash Bark Beetle (a/k/a White-banded Ash Bark Beetle) - Green ash

In the recent past, a number of city foresters and others have reported that relatively healthy green ash were being attacked, overwhelmed, and killed by mass attacks of the ash bark beetle in the genus Hylesinus (formerly Leperisinus). This type of damage and mortality was found, but the numbers of incidences were low and few trees were killed in this manner. All members of this genus are considered secondary; i.e. they attack trees severely weakened by drought, suffering from lawn mower damage, competition, or other stresses. Because of the drought conditions experienced in both 1988 and 1989, increased losses from this group are likely over the next few years. More than one species is involved, but the primary species implicated is the Eastern Ash Bark Beetle, Hylesinus aculeatus.

One member of the genus Hylesinus californicus, The Western Ash Bark Beetle, was found to be severely damaging green ash across the state. Younger, newly moved ash trees

in parks, recreation areas, and highway department plantings were especially hard hit. Stressed trees in any size class may be infested. The western ash bark beetle, however, does not attack the main trunk of the tree en masse. This species prefers to attack live trees under stress, inflicting damage to individual limbs or the main stem in the crown. Formation of the brood gallery, which encircles the branch, usually kills the branch or main stem from the point of attack outward. This species tends to reinfest the same trees year after year, progressively killing younger trees from the top downward. In larger trees the crowns are progressively thinned until the tree looses its vigor, aesthetic value, and ability to break the wind.

City crews in Devils Lake report that damage is common in all areas of the city. This insect is found across the entire state and seems to be on the increase. Black ash can be added to the host list in North Dakota. Eight 25-year old trees in Valley City were found to be infested, two of them contained moderate to high numbers of attacks.

Pine Bark Beetle Complex (Ips and Dendroctonus) - Ponderosa pine

In July, 1988, scattered groups of recently killed trees were found during a visit to a native stand of ponderosa pine in Slope County. A closer inspection revealed groups of two to ten trees had been killed by bark beetles. These bark beetles were found to be in the genus Ips, commonly referred to as engraver beetles. This was the first time bark beetles have been reported killing ponderosa pine in the area.

Because of the serious implications presented by the beetle kill occurring in our only major stand of native ponderosa pine, the US Forest Service Pest Management Division, Missoula, Montana, was contacted. Ken Gibson was dispatched from the Missoula office to help assess the impact of the bark beetle infestation.

The most prevalent species was found to be the six-spined ips, Ips Calligraphus. Associated insects such as the pine engraver, Ips pini, and the red turpentine beetle, Dendroctonus valens were also present. The latter two were not detected in every tree. None of the three is considered highly aggressive, but each is capable of killing trees weakened by other factors. Several years of below normal rainfall followed by a severe drought in 1988 are thought to be the main predisposing factors in this incidence.

Gibson termed the infestation as subepidemic. The population stabilized in 1989 and remains at about the same level as in 1988. An early spring storm deposited 8 to 10 inches of wet snow in the area in April of 1989, and possibly provided adequate moisture to enable the trees to resist attack. Without this moisture it is very likely that the

infestation rate and damage would have been much greater in 1989. Future infestation levels will be largely dependant on the amount of precipitation that falls in the area over the next several years.

Significantly, the highly aggressive mountain pine beetle, Dendroctonus ponderosae, has not been found. Its presence would almost certainly mean suppression efforts would be required to keep loses at an acceptable level.

A long-horned wood borer, tentatively identified as the white-spotted pine sawyer, Monochamus scutellatus, was found in a large percentage of dead and dying trees. The pine sawyer damages dying or recently dead trees by burrowing under the bark and into the sapwood and heartwood. Oftentimes, this damage renders the wood unsuitable for wood products.

Ash Borer (Lilac Borer) - Green ash

Present in young green ash statewide, the ash borer was most numerous in the southwest and south central areas of the state. Moderate populations were found in street trees in several cities and shade trees in parks, recreation areas, and highway department plantings, especially in locations south and west of the Missouri River. Light to moderate infestations were noted in shelterbelts surrounding the Bowman-Haley Dam Reservoir. Several black ash in Bismarck were lightly damaged by ash borers.

Carpenterworm - Green ash, hybrid poplars, and Siberian elm

Light to moderate populations appeared in green ash in southwest, south central, and northwest North Dakota. Light to moderate populations also occurred in hybrid poplars in south central and southwest North Dakota. Moderate damage occurred in the shelterbelts surrounding Bowman-Haley Reservoir. Larger green ash was the preferred host, with lesser populations in Siberian elm and hybrid poplars.

The heaviest infestations of this insect were found in the southwest and south central portions of the state. A native stand of green ash in a hardwood draw near the Missouri River in Billings was severely damaged by carpenterworms. The resulting structural weakening resulted in many trees dying or being blown over by the wind.

Poplar Borer - Aspen, cottonwood, and hybrid poplars

The poplar borer was most numerous in hybrid poplars in south central and southwest North Dakota in parks and urban areas. Oftentimes, both the poplar borer and carpenterworm were present in the same trees see carpenterworm). With the addition of White and Tower poplars to the list of hosts, the poplar borer has proven to be adapted to nearly all of our hybrid and native

poplars. Ironically, the least affected species seems to be the eastern cottonwood which has seldom been planted in recent years. This pest was also present in native aspen, causing extensive damage to open grown trees and trees along edges of fields, roads, or lakes. Because the poplar borer seems to show a preference for laying its eggs in sunny locations, it may be wise to delay or avoid pruning hybrid poplars when possible.

Bronze Birch Borer - Birch

Bronze birch borers continue to attack birches statewide, especially the cutleaf weeping birch which have been weakened by drought or other factors. Drought conditions in 1988 and 1989 have predisposed many birch to attack, and there is likely to be an increase in the number of trees damaged over the next several years. Bronze birch borer infestations may be contributing to a decline of native Birch in the Turtle Mountains in Bottineau and Rolette Counties, the Pembina Hills in Cavalier County, and the Killdeer Mountains in Dunn County.

Tip Borer - Scotch pine

Larvae, thought to be a species of Dioryctria, were found tunneling in and killing the current year's growth, usually terminals, on Scotch pine. These insects were detected in McHenry, Cavalier, and Pembina counties. Highest populations were in Christmas tree plantations in Pembina county. Because terminals are being killed, this insect could be of major concern to Christmas tree growers.

Tip Moth - Scotch and ponderosa pine

The tip moth was most numerous on ponderosa pine in the south central and southwestern areas of North Dakota. It may occasionally be found in the north central and northwestern areas of the state. The most severe damage was present on young tree reproduction in native stands in Slope County. Rarely has tip moth damage been observed north and east of a line extending from Crosby in the northwest to Ellendale in the southeast.

Metallic Pine Pitch Nodule Maker - Ponderosa, lodgepole, and Scotch pine

The metallic pine pitch nodule maker was found statewide on ponderosa pine. Heaviest populations recorded were in the south central and southwestern regions, but populations were low in the north central and northeastern areas. A lodgepole pine provenance planting on the A.R.S. station grounds in Mandan has a low population. Incidence on Scotch pine was restricted to a few attacks in one planting in Dickey county near Ellendale. This is the first report of the insect on Scotch pine in North Dakota, in spite of the fact that it commonly attacks scotch pine in Saskatchewan

HARDWOOD DEFOLIATORS

Cankerworms - Elms, boxelder, green ash

In 1988 and 1989, the perennial problem of complete defoliation from spring cankerworm was noted in many single-row Siberian elm shelterbelts in central and eastern North Dakota. The counties most seriously affected by the pest were Stutsman, Ramsey, Traill, Grand Forks, Bottineau, and Dunn. Nearly all single-row Siberian elm had at least some cankerworm defoliation. Moderate to heavy cankerworm defoliation was noted in native forests in the Missouri, Red, Pembina, Turtle, and Souris River valleys and their tributaries.

An additional problem is high populations of the fall cankerworm occurring simultaneous with spring cankerworm in some areas, notably the Missouri and Souris River drainages and the Devils Lake area. Where both species occur, spring cankerworm defoliate elms and the fall cankerworm defoliates green ash and boxelder. In some instances, even understory shrubs are completely defoliated after the larvae consume the foliage of the overstory trees. Where only spring cankerworm exist, green ash, boxelder and understory shrubs usually escape heavy defoliation. Fall cankerworm has been noted in single row green ash in several areas. Nearly complete defoliation was recorded on single row green ash belts in Burliegh, Morton, Traill, Grand Forks and Towner counties.

Prairie Tent Caterpillar - Chokecherry, prunus, and wild rose

The prairie tent caterpillar was common to locally abundant in the western two-thirds of the state. Chokecherry and wild rose are the preferred native species. Prairie tent attacks occur in cities on prunus and apple species. Very little actual defoliation occurs, but controls measures are often taken because people notice the nests and consider them unsightly.

Early Aspen Leaf Roller - Native aspen

The moderate to high populations reported in 1987 have collapsed, resulting in only light damage to a few localized areas in McHenry and Pierce counties and the Killdeer Mountains in 1988 and 1989.

Pear Slug - Cotoneaster and prunus

The pear slug has often caused complete defoliation of cotoneaster statewide. The central and north central areas of the state were especially hard hit. Pear slugs skeletonize leaves by consuming the upper surfaces causing the damage to superficially resemble fire blight injury. Consequently, the two pests are often confused.

CONIFER DEFOLIATORS

Introduced Pine Sawfly - Scotch and ponderosa pine

Scattered light to moderate infestations of introduced pine sawfly were noted on ponderosa and Scotch pine, mostly in the western half of the state.

Larch Sawfly - Siberian larch

The infestation level of larch sawfly on one plantation of Siberian larch at the Denbigh Experiment Forest remained very high in 1988. The infested trees were sprayed in early June with the insecticide Sevin 805 to reduce the population. The control measures were successful. Population levels remained low in 1989 and control measures were not necessary.

SAPSUCKING INSECTS AND MITES

Ash Plant Bug

Damage by the ash plant bug was noted in planted and native ash statewide. However, the insect was most numerous on planted ash in south central and southeastern regions. Moderate to heavy damage was noted in all size classes of ash, but the most serious damage was to young trees, especially those stressed by other factors.

Honeysuckle Witches-Broom Aphid - Tatarian honeysuckle

Honeysuckle aphids seriously damaged Tatarian honeysuckle statewide, effectively stopping new growth and reducing the usefulness of Tatarian honeysuckle. The seriousness of the infestation makes further usage of the Tatarian honeysuckle questionable.

Aphids - Many species of trees and shrubs

Severe damage was noted on aspen, hybrid poplars, oak, chokecherry, boxelder, green ash, American elm, snowball viburnum, spruces, and Scotch pine. Aphid populations can rise very quickly and then, oftentimes, abruptly decline from predation, especially by ladybird beetles and their larvae. Detection of aphids requires close inspection on a regular basis. The presence of ants on the foliage generally means aphid infestation of the plant. Treatment may be required on young trees, especially if new growth is being affected and feeding damage threatens the form or vigor.

Giant Conifer Aphid - Scotch pine and ponderosa pine

The giant conifer aphid was locally abundant on Scotch pine in south central and southwest North Dakota. The insect was also present on Scotch and ponderosa pines, primarily in the western half of the state.

Pine Needle Scale - Pines and spruces, especially muhgo pine

The highest populations of pine needle scale were in the north central and south central areas of the state on muhgo pine and Black Hills spruce. Infestations are often missed because of the difficulty of associating the tiny white specks with insect damage.

Spruce Spider Mite - Spruce, juniper, and arborvitae

High populations of mites were found in scattered locations throughout the state. Generally, mites are restricted to localized protected areas and are not likely to be found uniformly over an entire large tree. Smaller trees are more likely to be seriously infected.

Hot dry weather, such as we experienced in the spring and summer of 1988 and 1989, allows mites to build to high numbers. Cool weather slows their development. Rain and high winds often dislodges the mites and their eggs. Open grown trees and shrubs are seldom seriously infested. Foundation shrub plantings are the most seriously affected, especially those sheltered by buildings or other types of structures. Plants that are located on the south and west sides of buildings where temperatures are greater are at a higher risk. Spider mites prefer low-growing ornamental junipers. A separate species, the two-spotted mite, is often found on hardwood shrubs.

Diagnosis is difficult and spider-mite damage is often confused with winter drying, drought stress, or other factors. Due to this misdiagnosis, much needless spraying is done. This spraying may actually contribute to population buildups by eliminating predators.

GALL MAKING INSECTS AND MITES

Ash Flower Mite Gall - Green ash

Appeared on male ash trees statewide, very noticeable in the winter when the galls turn black and persist on the trees. Although they are unsightly, the galls cause little, if any, actual damage to the trees. Occasional damage by this mite occurs on female flowers or on the leaves.

Poplar Bud Gall Mite - Cottonwoods and other poplars

Occurs statewide, found primarily on cottonwood and northwest poplars and is particularly abundant on northwest poplar. The poplar bud gall mite may cause stunting, crooked growth, and rarely death of younger stressed trees.

Poplar vagabond aphid - Cottonwoods and other poplars

Occurs statewide, primarily objectionable because the relatively large galls persist throughout the season and are very noticeable after leafdrop. In reality, the trees suffer little, if any, actual physiological damage.

Oak Bullet Gall - Bur oak

This gall was discovered to be abundant in Williston. Some individual trees had large numbers of galls on nearly every branch. Because the galls persist on the trees for up to five years, the resulting accumulation of galls is very unsightly. This gall was a potentially a serious pest of Bur oak in ornamental plantings.

HARDWOOD DISEASES

Dutch Elm Disease - American elm

Increases in Dutch Elm Disease (DED) were noted in native populations of elm during 1988 and 1989. There seems to also accelerated losses from DED associated with the drought conditions. The exact reasons are speculative, but probably are due to a loss of vigor of native elms and the resulting increase in suitable brood wood for the native elm Bark Beetle, the principal vector of DED in North Dakota. DED can now be found in all the riparian forests along the Red, Souris, and Missouri Rivers and their tributaries. Many smaller pockets of native elm, where the trees are scattered or occur in small groups, have escaped injury to date. Windbreak plantings have not been seriously affected, except where they are proximate to native elm populations.

The level of disease was stable and, in some instances, even declined among cities with active sanitation and other management programs. The fate of elms in towns has varied widely. Towns isolated from major river valley tributaries, where infested native elm stands occur, have generally escaped serious losses. DED cannot be cured, but it can be managed to minimize the impact. Cities located in native elm areas which do not promptly remove infected trees and ignore elm firewood piles are hardest hit. One small community in the northeast had 75 percent of its elms dead or dying in 1988. As the disease continues to run its course in native elm and the number of infested elms in these areas declines, cities in the river valleys will see a decline in the number of trees lost to DED.

Western X Disease - Chokecherry

Western X disease symptoms occurred on native and planted chokecherry across the state. Symptoms include foliage which turns yellow or red in early summer, has smaller than normal leaves, and lacks fruit or has fruit which does not ripen normally. Infected trees show a distinct rosetting of leaves on branch tips, progressive reduction in growth, and eventually death.

Symptoms are present on common chokecherry in nearly every county, and are widely found on the ornamental chokecherry variety known as Canada red cherry (Shubert chokecherry). While many factors may cause chokecherry to exhibit some of the symptoms characteristic of Western X disease, the presence of all of the above described symptoms on the same stem indicates a very high likelihood that

Western X disease is present. Laboratory diagnosis is difficult. Pathologists at North Dakota State University are currently working to identify methods to confirm the presence of Western X disease. Until then, the eventual impact on native chokecherry, Canada red cherry, and other susceptible prunus species is unknown.

Leaf Diseases and Rusts - Many species

Due to hot, dry conditions, leaf diseases and rusts were reduced to the point of little noticeable damage. No serious damage was observed in either 1988 or 1989.

Fire Blight - Apple, crabapple, and cotoneaster

Fire blight was present statewide on susceptible varieties of apples and ornamental crabapples. A trend towards planting less susceptible varieties has gradually reduced the incidence, but has not eliminated fire blight as a serious problem in North Dakota. Siberian crabapple trees in windbreaks are susceptible and may be seriously affected. Localized conditions caused infestation levels to be high in the Dickinson area in 1989. Fire blight was found on cotoneaster statewide. An insect (see pear slug) causes symptoms which are often confused with fire blight. In the case of pear slug infestation, a closer inspection reveals skeletonizing on the upper surface of the leaf and the possible presence of larvae. While treatment with an insecticide is an effective control for pear slugs, no pesticide is currently registered for fire blight control on cotoneaster.

Poplar Canker - Cottonwood and hybrid poplars

Poplar cankers are an important cause of branch and stem mortality in hybrid poplars. Some poplar clones, especially those stressed by drought, other environmental factors, or of borderline hardiness, are most seriously affected. For undetermined reasons, cankers where especially bad in 1989.

Siberian Elm Cankers - Siberian elm

Many shelterbelts, especially single-row, have been infected by cankers and are in a state of serious decline. These branch cankers are playing an important role in the deterioration process. Many miles of single-row Siberian elm shelterbelts are being removed each year, few are being replaced.

Russian Olive Cankers - Russian olive

Russian olive, especially shelterbelts in cultivated areas, continue to be plagued by branch dieback from cankers.

Cankers seem to be more numerous on trees near cereal crops. This higher incidence may be related to more frequent direct exposure of trees to herbicides such as 2,4-D. Many healthy trees, some of them large and obviously quite old, continue to thrive in cities and parks where they have more room to grow and their exposure to crop sprays is lessened.

Black Knot - Chokecherry and mayday

Black knot disease appears to be on the increase on ornamentals in cities and towns. Canada red cherry is often attacked. When the diseased branches are not trimmed out, the incidence of disease increases year to year. Mayday trees seem to be particularly vulnerable and many have been removed because of deformities caused by black knot.

Native chokecherry is infested with black knot disease statewide. Some chokecherry clones are heavily infected with one or more knots present on nearly every branch. Where heavily infected chokecherry are in close proximity to ornamental varieties of prunus, diseased plants should be removed. A number of insects infest the knots and may reduce spore production.

Wetwood (Slime Flux) - Cottonwood, hybrid poplar, and elm

A high percentage of cottonwood, hybrid poplar, and elm trees over approximately 30 years old, are infected with bacterial wetwood. Outward signs of the disease are not always obvious. When wetwood toxins are transported into the branches of a tree's crown, wilting of the leaves may occur. Branch dieback and general tree decline can result. Damage caused by this wetwood is more common than generally accepted by resource managers and landowners. In several instances, wetwood has been judged to be the primary cause of decline or death of trees.

CONIFER DISEASES

Rhizophaera Needlecast - Blue spruce

Rhizophaera needlecast on spruce was most prevalent in the north central and northeastern areas of the state. Several cases of serious damage were noted on ornamental and shelterbelt plantings. Branches on the north or east sides of sheltered or crowded trees are most likely to be affected. Dry conditions in 1988 and 1989 may have lessened the impact of this disease.

Lirula Needlecast - Black Hills spruce and white spruce

Lirula needlecast disease was found primarily in north central, northeast, and southeast portions of North Dakota. A planting on the Wokapa Game Management area in Rolette county sustained light to moderate damage. Needlecast of spruce are more likely to affect sheltered trees (see Rhizophaera).

Unknown Tip Dieback - Scotch and ponderosa pines

A characteristic tip dieback symptom was found on pines in Bottineau, Burleigh, McLean, Mercer, Morton, Ramsey, Rolette, Walsh, and Ward Counties occurring on the current year's growth. In some cases, the entire year's growth was dead. In other cases, all needles and bark tissue beyond a certain point were dead. No sign of insect activity or disease damage could be found.

Diplodia Tip Blight - Ponderosa pine

Diplodia tip blight was identified on trees at the Denbigh Dunes Experiment Station in McHenry county, the A.R.S. station grounds in Morton County, a private residence in the city of Dickinson, and on native pines at the Logging Camp Ranch in Slope County. All of the infested trees were over 40 years old. The Morton county shelterbelt is one of the oldest ponderosa pine plantings in the state. The disease spores were isolated from second year cones.

Cytospora Canker - Spruce

Cytospora canker caused damage to spruce, mostly across the eastern two-thirds of the state. Older trees or trees stressed by sod competition, drought, or root injury are especially susceptible to this canker. Any serious decline in the health of a tree may allow invasion of the organism. Infestations generally start with branches near the bottom of the tree. Crowding in the row or by adjacent trees has been implicated as a predisposing factor.

Western Gall Rust - Ponderosa and scotch pines

Western gall rust was found in pine plantations in McHenry, Bottineau, Pembina, Mercer, and Morton counties; several shelterbelts scattered throughout the state; and in native ponderosa pine in Slope County. The incidence of this disease is on the rise in planted ponderosa pine.

Sooty Mold - Ponderosa pine

Sooty mold was found in a pine plantation in the Denbigh Experimental Forest in McHenry county and one in Bottineau

county. In both plantations trees are crowded, restricting air movement and sunlight penetration. The mold gives affected needles a dusky, dark grey color. Although unsightly, it is not thought to cause death of the infected needles.

ABIOTIC FACTORS

Herbicide Damage - Many species

Herbicide injury has become an increasing problem for many tree species during recent years. In addition to the more "traditional" phenoxy herbicide injury (2,4-D drift), there has been increased damage from pre-emergent sprays. The list of approved herbicides for use on trees, shrubs, field crops, and ornamentals grows every year. In some cases, injury symptoms of these herbicides on woody plants is unknown.

In addition, the source of the chemicals may not be obvious. Potentially harmful herbicides are sometimes added to "weed and feed" type lawn fertilizers or they may leach into the root zone of trees from nearby crops. Several cases of alleged injury to high-value shade trees are being litigated in the state, and settlement may cost many thousands of dollars. In some instances, where variable soil and weather conditions exist, the application of herbicides according to label recommendations may cause injury to nearby trees. Boxelder, Siberian elm, Amur maple, and grape are particularly sensitive to 2,4-D injury. Direct herbicide application is not always necessary for these plants to show damage symptoms. Phenoxy herbicide injury has been implicated in the decline of Siberian elm, notable in single-row belts. Cottonwood seems to be especially sensitive to root injury by Tordon and other soil-applied chemicals. Extreme care and constant vigilance is needed to prevent herbicide and other chemical damage to trees and shrubs.

Fertilizer Damage - Many species

Conifers, especially spruce in highly-fertilized and maintained lawns, seem to be prone to winter damage. It is suspected that late summer or early fall applications of nitrogen keep plants from becoming dormant as early as they should. No doubt, the same type of damage may occur on deciduous trees and shrubs, but may not be as noticeable as on conifers.

Drought Damage

Very hot and dry conditions in 1988 and 1989 affected all trees and shrubs in the state in some manner. Newly planted trees, especially field windbreaks and others which did not receive supplemental watering, often failed completely or had very poor survival. Trees under stress from insect attack or disease, severe competition by sod, or overcrowding were killed by the drought. Many trees of all species, especially those less drought tolerant, were put into decline and losses will occur for several years to come.

Stressed trees are more prone to attack by insects and disease. Boring insects and bark beetles favor dry periods and weakened trees.

Table I

INCIDENCE AND POTENTIAL IMPORTANCE OF PESTS
COMMONLY OCCURRING IN NORTH DAKOTA

KEY TO PLANTING TYPE AND DAMAGE RATING

Type of Forest or Planting	Present Incidence	Potential for increased or Sustained High Populations
URB - Urban	1 - High Population	A - Highly likely
SHL - Shelterbelts	2 - Moderate Population	B - Moderately likely
PRK - Parks	3 - Low Population	C - Not likely
NAT - Native	4 - Present, but insignificant	

PEST/HOST	CATEGORY AND DAMAGE RATING	COMMENTS
DEFOLIATING INSECTS		
Ash grey blister beetle/ caragana	URB-3B, SHL-3B, PRK-3B	
Aspen leaf roller/ Native aspen	PRK-3C, NAT-3B	
Blackheaded ash sawfly/ green ash	URB-4B, SHL-4B, PRK-4B, NAT-4B	
Cercropia moth/green ash, boxelder, lilac, chokecherry	URB-4B, SHL-3B, PRK-3B, NAT-4B	
Cottonwood leaf beetle/ poplars, willows	URB-3B, SHL-4B, PRK-3B, NAT-3B	
Elm leaf beetle/ Siberian elm	URB-2A, SHL-4A, PRK-3A	
Elm sawfly/elms, white willow	URB-4B, SHL-3B, PRK-3B, NAT-4B	
European pine sawfly/ Scotch pine	URB-4B, SHL-3B, PRK-3B	
Fall cankerworm/ Primarily elms green ash, boxelder	URB-3B, SHL-3B, PRK-3B, NAT-2B	Single-row green ash, east, s.east

PEST/HOST	CATEGORY AND DAMAGE RATING	COMMENTS
Fall webworm/elms, prunus, populus, willow	URB-3C, SHL-3B, PRK-3B, NAT-2B	Higher populations in SW and SC
Forest Tent caterpillar/ aspen	URB-3B, SHL-4C, PRK-2B, NAT-3A	
Fruit tree Leaf Roller/ green ash	URB-3B, SHL-3B, PRK-3B, NAT-4C	
Grasshoppers/caragana	URB-4C, SHL-2A, PRK-2A	
Great ash sphinx/ green ash	URB-4B, SHL-4C, PRK-4B, NAT-4C	
Hackberry caterpillar/ Hackberry	URB-4B, SHL-4B, PRK-3B, NAT-4C	
Introduced pine sawfly/ ponderosa & Scotch pine	URB-4B, SHL-3B, PRK-3B, NAT-4B	
Larch sawfly/Siberian larch	URB-4A, SHL-4A, PRK-3A	
Leaf crumpler/cotoneaster, hawthorne	URB-3B, SHL-3B, PRK-3B	
Linden looper/elms, boxelder, prunus	URB-3B, SHL-3B, PRK-2B, NAT-3B	Often found with cankerworm
Mourningcloak butterfly (spiny elm caterpillar)/ elms	URB-3B, SHL-3C, PRK-2B, NAT-4C	
Pear slug/ prunus, cotoneaster	URB-1A, SHL-2A, PRK-2A, NAT-3B	Especially in central & west on cotoneaster
Red humped oakworm/ burr oak	URB-4C, SHL-4C, PRK-4B, NAT-3B	
Spring Cankerworm/ elms, Am. elm, Sib. elm	URB-2A, SLH-1A, PRK-2B, NAT-2B	
Spruce budworm/spruces	URB-4B, SHL-4B, PRK-4B	
Ugly nest tent caterpillar/chokecherry	URB-3B, SHL-3B, PRK-3B, NAT-3B	
Variable oak leaf caterpillar/burr oak	URB-4C, SHL-4C, PRK-4B, NAT-4B	

PEST/HOST	CATEGORY AND DAMAGE RATING	COMMENTS
Yellow-headed spruce sawfly/spruces	URB-4B, SHL-4B, PRK-4B	
Yellow-necked caterpillar/ burr oak	URB-4B, SHL-4B, PRK-3A, NAT-3A	
HARDWOOD BORERS, BARK BEETLES, AND LEAF MINERS		
Ash borer/green ash Lilacs,	URB-2A, SHL-3B, PRK-2A, NAT-3B	Mostly young trees to 6" diameter
Ash & privet borer/ green ash	URB-3B, SHL-3A, PRK-3B, NAT-3B	
Boxelder twig borer/ boxelder	URB-2A, SHL-3A, PRK-3A, NAT-3B	
Bronze birch borer/cutleaf weeping birch, other birches	URB-1A, PRK-1A, NAT-2B	
Bronze poplar borer	URB-3B, SHL-3B, PRK-3B, NAT-4C	
Carpenterworm/green ash,	URB-3B, SHL-3B, PRK-2A, NAT-3B	Mainly larger trees over 6" diameter
Cottonwood borer/ cottonwood, poplars	URB-4C, SHL-4C, PRK-4B, NAT-4C	
European elm bark beetle/elms	URB-3B, SHL-3B, PRK-3B, NAT-3B	
Native elm bark beetle/ American elm	URB-2A, SHL-2A, PRK-2A, NAT-1A	
Peach bark beetle/ chokecherry, Juneberry, Mt. ash	URB-3B, SHL-2B, PRK-3B, NAT-3B	In weakened trees
Peach tree borer/ prunus	URB-4B, SHL-3B, PRK-3B, NAT-3B	
Poplar borer/hybrid poplars, cottonwood, aspen	URB-3B, SHL-3B, PRK-2A, NAT-3B	Prefers open grown trees
Poplar and willow borer	URB-4B, SHL-3B, PRK-3A, NAT-2A	N.C. & N.E.

PEST/HOST	CATEGORY AND DAMAGE RATING	COMMENTS
Shothole borer/ chokecherry, Juneberry, Mt. ash, hawthorne	URB-3B, SHL-2B, PRK-3B, NAT-3B	In weakened trees
CONIFER BORERS		
Larch case bearer	URB-4C, SHL-4B, PRK-4B	
Metallic pine pitch nodule maker/ponderosa pine	URB-3A, SHL-3A, PRK-2A, NAT-3B	
Pine needle sheath miner/ pines	URB-4B, SHL-3B, PRK-3B, NAT-4C	
Pine weevil/ponderosa and Scotch pine	URB-4C, SHL-3B, PRK-4B	
Spruce needle miner/spruce	URB-4B, SHL-3B, PRK-4B	
Western pine tip moth/ ponderosa & Scotch pine	URB-4B, SHL-3A, PRK-2A, NAT-1B	Southwest and South Central
White pine weevil/spruce	URB-4C, SHL-4B, PRK-4B	Northeast and North Central
Zimmerman pine moth/ ponderosa and scotch pine	URB-4B, SHL-4B, PRK-4B, NAT-4B	
SAPSUCKING INSECTS & MITES		
Ash plant bug	URB-2B, SHL-1A, PRK-2B, NAT-2B	
Caragana aphid/caragana	URB-3B, SHL-3B, PRK-2B	
Chokecherry aphid/ chokecherry	URB-2B, SHL-2A, PRK-1A, NAT-3B	
Elm lace bug	URB-4B, SHL-4B, PRK-4B, NAT-4B	
European Elm Scale	URB-2A, SHL-3B, PRK-3B, NAT-3B	
European fruit lacanium scale/elms, green ash, boxelder	URB-3B, SHL-4C, PRK-3B, NAT-4C	
Giant conifer aphid/ ponderosa & Scotch pine	URB-3B, SHL-4B, PRK-3A, NAT-4C	
Honeysuckle witches'-broom aphid/Tatarian honeysuckle	URB-1A, SHL-1A, PRK-1A	

PEST/HOST	CATEGORY AND DAMAGE RATING	COMMENTS
Lace bug/cotoneaster & Juneberry	URB-3B, SHL-4B, PRK-3B, NAT-3B	
Oak lace bug/Burr oak	URB-4C, SHL-4C, PRK-3B, NAT-1B	In native-oak areas
Oyster shell scale/prunus, cotoneaster, Juneberry	URB-2B, SHL-2B, PRK-2B, NAT-2B	
Pine needle scale/scotch & mugho pine, spruces	URB-2B, SHL-3C, PRK-2A	
Scurfy scale/ Poplars	URB-3B, SHL-3B, PRK-3B, NAT-3B	
Spruce Spider mite/spruce	URB-2B, SHL-3C, PRK-2B	Protected sites or drought periods
Woolly elm aphid/ American lem	URB-2A, SHL-3A, PRK-2A, NAT-3B	
GALL MAKING INSECTS AND MITES		
Ash flower gall mite/ green ash	URB-2B, SHL-2B, PRK-2B, NAT-2B	
Hackberry nipple gall	URB-3A, SHL-3A, PRK-3A	
Oak Bullet Gall	URB-2A, SHL-3B, PRK-3B, NAT-4C	
Poplar bud gall mite	URB-3B, SHL-2B, PRK-2B, NAT-2B	
Poplar petiole gall aphid cottonwood	URB-3B, SHL-3B, PRK-3B, NAT-3B	
Poplar vagabond aphid gall/cottonwood	URB-3B, SHL-3B, PRK-2B	

Table II

INCIDENCE AND POTENTIAL IMPORTANCE OF PESTS
COMMONLY OCCURRING IN NORTH DAKOTA

KEY TO PLANTING TYPE AND DAMAGE RATING

Type of Forest or Planting	Present Incidence	Potential for increased or Sustained High Populations
URB - Urban	1 - High Population	A - Highly likely
SHL - Shelterbelts	2 - Moderate Population	
PRK - Parks	3 - Low Population	B - Moderately likely
NAT - Native	4 - Present, but insignificant	C - Not likely

PEST/HOST	CATEGORY AND DAMAGE RATING	COMMENTS
HARDWOOD DISEASES		
Ash anthracnose green ash	URB-3A, SHL-3A, PRK-3A, NAT-4B	
Black knot chokecherry, Mayday	URB-2B, SHL-2B, PRK-2B, NAT-2C	
Cedar apple rust Hawthorn, Juneberry	URB-2A, SHL-2B, PRK-2B, NAT-3C	
Dutch elm disease American elm	URB-2A, SHL-1B, PRK-2A, NAT-1A	
Fireblight Apple, crab apple	URB-2B, SHL-2B, PRK-2B, NAT-3C	
Poplar canker Hybrid poplars	URB-2B, SHL-2A, PRK-2A, NAT-3B	
Russian olive canker Russian olive	URB-2B, SHL-2B, PRK-2B	
Siberian elm canker Siberian elm	URB-2A, SHL-1A, PRK-2A	
Valsa canker Prunus sp.	URB-3B, SHL-3B, PRK-3B	
Western X disease Chokecherry	URB-2B, SHL-2B, PRK-2B, NAT-1B	

PEST/HOST	CATEGORY AND DAMAGE RATING	COMMENTS
Wetwood Elm, cottonwood, hybrid poplar	URB-1A, SHL-1B, PRK-1A, NAT-2B	
CONIFER DISEASES		
Cedar apple rust juniper, cedar	URB-2B, SHL-2B, PRK-2B, NAT-3C	
Cytospora canker Blue spruce	URB-2B, SHL-2B, PRK-2B	
Diplodia blight Ponderosa pine	URB-3B, SHL-3B, PRK-3B, NAT-3C	
Dothistroma blight Pines	URB-4B, SHL-4B, PRK-4A, NAT-4C	
Kabatina tip blight Junipers	URB-2B, SHL-3B, PRK-2B, NAT-3C	
Naemacyclus needlecast Pines	URB-4B, SHL-3B, PRK-3B, NAT-4C	
Rhizophaera needlecast Blue spruce	URB-3B, SHL-3B, PRK-3B	
Western gall rust Ponderosa pine	URB-3B, SHL-3B, PRK-3B, NAT-3C	

PESTS	SCIENTIFIC NAME
Ash and privet borer	Tylonotus bimaculatus
Ash borer	Podosesia syringae
Ash flower gall mite	Eriophyes fraxiniflora
Ash gray blister beetle	Epicauta fabricii
Ash plant bug	Neoborus amoenus
Aspen leafminer	Phyllocnistis populiella
Blackheaded ash sawfly	Tethida cordigera
Boxelder twig borer	Proteoteras willingana
Bronze poplar borer	Agrilus liragus
Bronze birch borer	Agrilus anxius
Caragana aphid	Acyrthosiphon caraganae
Caragana blister beetle	Epicauta subglabra
Carpenterworm	Prionoxystus robiniae
Cecropia moth	Hyalophora cecropia
Chokeccherry aphid	Aphis cerasifolia
Cottonwood borer	Plectrodera scalator
Cottonwood leaf beetle	Chrysomela scripta
Early aspen leaf roller	Pseudexentra oregonana
Eastern ash bark beetle	Hylesinus aculeatus
Elm lacebug	Corythucha ulmi
Elm leaf beetle	Pyrrhalta luteola
Elm sawfly	Cimbex americana
European elm bark beetle	Scolytus multistiatus
European elm scale	Gossyparia spuria
European fruit lecanium	Lecanium corni
European pine sawfly	Neodiprion sertifer
Fall cankerworm	Alsophila pometaria
Fall webworm	Hyphantria cunea
Forest tent caterpillar	Malacosoma disstria
Fruit tree leafroller	Archips argyrospilus
Giant conifer aphid	Cinara species
Grasshopper	Melanoplus species
Great ash spinx	Sphinx chersis
Hackberry caterpillar	Asterocampa celtis
Hackberry nipplegall maker	Pachypsylla celtidismamma
Honeysuckle witches broom aphid	Hyadaphis tataricae
Introduced pine sawfly	Diprion similis
Lace bug	Corythucha species
Larch casebearer	Coleophora laricella
Larch sawfly	Pristiphora erichsonii
Leaf crumpler	Arobasis indigenella
Linden looper	Erannis tiliaria
Metallic pine pitch nodule maker	Retinia metallica
Mourningcloak butterfly	Nymphalis antiopa
Native elm bark beetle	Hylurgopinus rufipes
Oak bullet gall	Disholcaspis quercusmamma
Oak lace bug	Corythucha arcuata
Oystershell scale	Lepidosaphes ulmi

PESTS	SCIENTIFIC NAME
Peach bark beetle	Phloetribus liminaris
Peach tree borer	Synanthedon pictipes
Pear slug	Caliroa cerasi
Pine needle scale	Chionaspis pinifoliae
Pine needle sheath miner	Zelleria Heimbachi
Pine weevil	Pissodes species
Poplar and willow borer	Crypthorhynchus lapathi
Poplar borer	Saperda calcarata
Poplar bud gall mite	Aceria parapopuli
Poplar petiole gall aphid	Pemphigus populitransversus
Poplar vagabond aphid	Mordwilkoja vagabunda
Prairie tent caterpillar	Malacosoma californicum lutescens
Red humped oakworm	Symmerista albifrons
Scurfy scale	Chionaspis species
Shothole borer	Scolytus rugulosus
Smaller European elm bark beetle	Scolytus multistriatus
Spider mite	Oligonychus species, Tetranychus species & Eotetranychus species
Spring cankerworm	Paleacrita vernata
Spruce budworm	Choristoneura fumiferana
Spruce needle miner	Taniva albolineana
Spruce gall midge	Mayetiola piceae
Spruce spider mite	Oligonchus ununguis
Tip borer, Scotch pine	Dioryctria species
Tip moths	Rhyacionia species
Uglynest caterpillar	Archips cerasivoranus
Variable oakleaf caterpillar	Heterocampa manteo
Western ash bark beetle	Hylesinus californicus
Western pine tip moth	Rhyaciona bushnelli
White-banded ash bark beetle	Hylensinus fasciatus
White pine weevil	Pissodes strobi
White-spotted pine sawyer	Monochamus scutellatus
Woolly elm aphid	Eriosoma americanum
Yellow-headed spruce sawfly	Pikonema alaskensis
Yellow-necked caterpillar	Datana ministra
Zimmerman pine moth	Dioryctria zimmermani

DISEASES	SCIENTIFIC NAME
Ash anthracnose	Gloeosporium aridum
Black knot	Apiosporina morbosa
Cedar apple rust	Gymnosporangium sp.
Cytospora canker	Cytospora kunzei
Diplodia blight	Diplodia pinea
Dothistroma blight	Dothistroma pini
Dutch elm disease	Ceratocystis ulmi
Fireblight	Erwinia amylovora
Kabatina tip blight	Kabatina juniperi
Lirula needlecast	Lirula macrospora
Naemaeyclus needlecast	Naemaeyclus minor
Poplar cankers	Cytospora sp. Phomopsis sp. Dothichiza populea Septoria musiva
Rhizosphaera needlecast	Rhizosphaera kalkhoffii
Russian olive canker	Botryodiplodia theobromae Tuberculariа ulmea Phomopsis arnoldiae
Siberian elm canker	Botryodiplodia hypodermia Tuberculariа ulmea
Sooty mold	Unknown sp.
Valsa canker	Valsa sp.
Western gall rust	Endocronartium harknessii
Western X disease	A Mycoplasma like organism (MLO)
Wetwood	Enterobacter cloacae